$$\omega \to 0 \Rightarrow x_m = \frac{F_m}{k}$$

$$\omega \to \omega_0 = 30\ rad.s^{-1} \Rightarrow x_m \to \infty \text{ (résonance très aigue)}$$

On risque de détruire le ressort

2°)

a-

$$\underline{RFD}\ \vec{P}+\vec{R}+\vec{T}+\vec{F}+\vec{f}=m\vec{a}$$

$$\underline{Proj}: T + f + F = ma \Rightarrow -kx - hv + F = ma$$

$$\Rightarrow ma + hv + kx = F$$

$$\Rightarrow \frac{md^2x}{dt^2} + \frac{hdx}{dt} + kx = F$$

$$x(t) = x_m \sin(\omega t + \varphi_x)$$

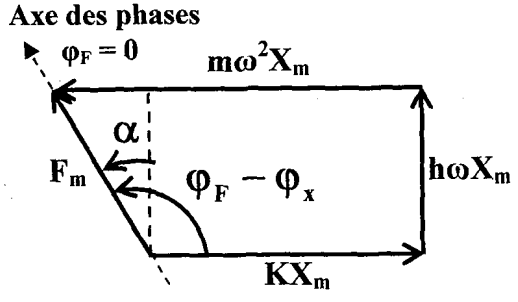
$$kx \to \vec{V_1}(KX_m;\varphi_x)$$

$$h\frac{dx}{dt} \to \vec{V_2}(h\omega X_m;\varphi_x + \frac{\pi}{2})$$

$$m\frac{d^2x}{dt^2} \to \vec{V_3}(m\omega^2 X_m;\varphi_x + \pi)$$

$$F \to \vec{V}(F_m;\varphi_F = 0)$$

$$\vec{V} = \vec{V_1} + \vec{V_2} + \vec{V_3}$$



$$\omega = 40\ rads^{-1} > \omega_0 = 30\ rads \Rightarrow m\omega^2 > k$$

$$Fm^2 = h^2\omega^2 x_m{}^2 + (m\omega^2 x_m - kx_m)^2$$

$$= x_m^2\left(h^2\omega^2 + (m\omega^2 - k)^2\right)$$

$$x_m = \frac{F_m}{\sqrt{h^2\omega^2 + (m\omega^2 - k)^2}}$$

$$x_m = \frac{4,5}{\sqrt{0,25.40^2 + (160 - 90)^2}} = 6,18.10^{-2}m$$

$$tg(\alpha) = \frac{m\omega^2 - k}{h\omega} = \frac{160 - 90}{20} = 3,5 \Rightarrow (\alpha) = 1,29rad$$

$$\varphi_F - \varphi_x = \alpha + \frac{\pi}{2} = 2,86rad\ rad \Rightarrow \varphi_x = -2,86\ rad$$

$$x(t) = 6,180.10^{-2}\sin(40t - 2,86) \text{ en m}$$

$$x_m = \frac{F_m}{\sqrt{h^2\omega^2 + (m\omega^2 - k)^2}}$$

b- résonance d'élongation (d'amplitude)

x_{max} **est maximale**

$$\Rightarrow g(\omega) = h^2\omega^2 + (m\omega^2 - k)^2 \text{ est min}$$

$$\Rightarrow g'(\omega) = 0$$

$$\Rightarrow 2h^2\omega + 2(m\omega^2 - k)2m\omega = 0$$

$$\Rightarrow 2\omega(h^2 + 2m(m\omega^2 - k)) = 0$$

$$\omega \neq 0$$